

WHAT IS CLAIMED IS:

1. A method of manufacturing an electronic device comprising the steps of:

(a) forming, on an underlying layer, an insulating film made from one of an oxide film, a nitride film, an oxinitride film, an organic film and an organic-inorganic hybrid film;

(b) forming a resist pattern on said insulating film;

(c) forming an insulating film pattern by etching said insulating film with said resist pattern used as a mask;

(d) conducting a plasma treatment on exposed portions of said underlying layer and said insulating film pattern without removing said resist pattern after the step (c); and

(e) etching said underlying layer with said resist pattern and said insulating film pattern used as a mask.

2. The method of manufacturing an electronic device of Claim 1,

wherein said plasma treatment is conducted by using a gas including at least one of a N_2 gas, an O_2 gas and an inert gas in the step (d).

3. The method of manufacturing an electronic device of Claim 1,

wherein said underlying layer is made from one of a monosilicon layer, a silicon substrate, a polysilicon film, an amorphous silicon film, an organic film, an organic-inorganic hybrid film, a nitride film and an oxide film, and

said underlying layer is etched with a chlorine-containing gas or a bromine-containing gas in the step (e).

4. The method of manufacturing an electronic device of Claim 1,

5 wherein said insulating film is made from one of an oxide film, a nitride film, an oxinitride film, an organic film and an organic-inorganic hybrid film.

5. The method of manufacturing an electronic device of Claim 4,

10 wherein said insulating film is a silicon nitride film, and

said insulating film of said silicon nitride film is etched with a fluorine-containing gas in the step (c).

15 6. The method of manufacturing an electronic device of Claim 1,

wherein said underlying layer is one of a surface portion of a silicon substrate, an electrode, an interconnect and an interlayer insulating film.

20 7. A method of manufacturing an electronic device comprising the steps of:

(a) forming an insulating film on an underlying layer;
(b) forming a resist pattern on said insulating film;
(c) forming an insulating film pattern by etching said insulating film with said resist pattern used as a mask;

25 (d) cleaning said underlying layer after the step (c);

and

(e) etching said underlying layer with at least said insulating film pattern used as a mask.

8. The method of manufacturing an electronic device of
5 Claim 7,

wherein water is used as a cleaning solution in the step (d).

9. The method of manufacturing an electronic device of
Claim 7,

10 wherein a cleaning solution is kept at 50°C or more in the step (d).

10. The method of manufacturing an electronic device of
Claim 7,

15 wherein an aqueous solution of tetramethyl ammonium hydride is used as a cleaning solution in the step (d).

11. The method of manufacturing an electronic device of
Claim 7,

wherein a diluted hydrofluoric acid aqueous solution is used as a cleaning solution in the step (d).

20 12. The method of manufacturing an electronic device of
Claim 7,

wherein said insulating film is made from one of an oxide film, a nitride film, an oxinitride film, an organic film and an organic-inorganic hybrid film.

25 13. The method of manufacturing an electronic device of

Claim 12,

wherein said insulating film is a silicon nitride film or a silicon oxinitride film, and

the method further comprises a step of exposing a substrate to the air between the step (c) and the step (d).

14. The method of manufacturing an electronic device of Claim 7,

wherein said underlying layer is made from one of a monosilicon layer, a silicon substrate, a polysilicon film, an amorphous silicon film, an organic film, an organic-inorganic hybrid film, a nitride film and an oxide film, and

said underlying layer is etched with a chlorine-containing gas or a bromine-containing gas in the step (e).

15. The method of manufacturing an electronic device of Claim 14,

wherein said insulating film is a silicon nitride film, and

said insulating film of said silicon nitride film is etched with a fluorine-containing gas in the step (c).

16. The method of manufacturing an electronic device of Claim 7,

wherein said underlying layer is one of a surface portion of a silicon substrate, an electrode, an interconnect and an interlayer insulating film.

17. A method of manufacturing an electronic device

comprising the steps of:

- (a) forming an insulating film on an underlying layer;
- (b) forming a resist pattern on said insulating film;
- (c) forming an insulating film pattern by etching said
5 insulating film with said resist pattern used as a mask;
- (d) conducting a heat treatment on a substrate without
removing said resist pattern after the step (c); and
- (e) etching said underlying layer with said resist
pattern and said insulating film pattern used as a mask.

10 18. The method of manufacturing an electronic device of
Claim 17,

wherein said heat treatment is conducted under vacuum in
the step (d).

15 19. The method of manufacturing an electronic device of
Claim 17,

wherein said underlying layer is made from one of a
monosilicon layer, a silicon substrate, a polysilicon film,
an amorphous silicon film, an organic film, an organic-
inorganic hybrid film, a nitride film and an oxide film, and

20 said underlying layer is etched with a chlorine-
containing gas or a bromine-containing gas in the step (e).

20. The method of manufacturing an electronic device of
Claim 17,

25 wherein said insulating film is made from one of an
oxide film, a nitride film, an oxinitride film, an organic

film, and an organic-inorganic hybrid film.

21. The method of manufacturing an electronic device of Claim 20,

wherein said insulating film is a silicon nitride film,
and

said insulating film of said silicon nitride film is etched with a fluorine-containing gas in the step (c).

22. The method of manufacturing an electronic device of Claim 17,

wherein said underlying layer is one of a surface portion of a silicon substrate, an electrode, an interconnect and an interlayer insulating film.

23. A method of manufacturing an electronic device comprising the steps of:

(a) forming an insulating film on an underlying layer of titanium nitride;

(b) forming a resist pattern on said insulating film;

(c) forming an insulating film pattern by etching said insulating film with said resist pattern used as a mask;

(d) conducting a plasma treatment on exposed portions of said underlying layer and said insulating film pattern after the step (c); and

(e) etching said underlying layer with said insulating film pattern used as a mask by using a halogen-containing gas.

24. The method of manufacturing an electronic device of

Claim 23,

wherein said insulating film is made from one of an oxide film, a nitride film, an oxinitride film, an organic film and an organic-inorganic hybrid film.

5 25. A method of manufacturing an electronic device comprising the steps of:

(a) forming an insulating film including nitrogen on an underlying layer;

10 (b) conducting a heat treatment on said insulating film for removing NH_x , wherein x is an arbitral value;

(c) forming a resist pattern on said insulating film;

(d) forming an insulating film pattern by etching said insulating film with said resist pattern used as a mask; and

15 (e) etching said underlying layer with said resist pattern and said insulating film pattern used as a mask.

26. A method of manufacturing an electronic device comprising the steps of:

(a) forming an insulating film on an underlying layer;

(b) forming a protecting film on said insulating film;

20 (c) forming a resist pattern on said protecting film;

(d) forming an insulating film pattern by etching said protecting film and said insulating film with said resist pattern used as a mask; and

25 (e) etching said underlying layer with said resist pattern and said insulating film pattern used as a mask.

27. The method of manufacturing an electronic device of
Claim 26,

wherein said insulating film is made from one of an
oxide film, a nitride film, an oxinitride film, an organic
5 film and an organic-inorganic hybrid film.

28. The method of manufacturing an electronic device of
Claim 27,

wherein said insulating film is a silicon nitride film,
and

10 said protecting film is an oxide film formed by
oxidizing a surface portion of said insulating film in the
step (b).

29. The method of manufacturing an electronic device of
Claim 26,

15 wherein said protecting film is made from at least one
of a silicon oxide film and a silicon oxinitride film.

30. The method of manufacturing an electronic device of
Claim 26,

20 wherein said underlying layer is made from one of a
monosilicon layer, a silicon substrate, a polysilicon film,
an amorphous silicon film, an organic film, an organic-
inorganic hybrid film, a nitride film and an oxide film, and

said underlying layer is etched with a chlorine-
containing gas or a bromine-containing gas in the step (e).

25 31. The method of manufacturing an electronic device of

Claim 30,

wherein said underlying layer is a silicon nitride film,
and

said insulating film is etched with a fluorine-
5 containing gas in the step (d).

32. The method of manufacturing an electronic device of
Claim 30,

wherein said underlying layer is one of a surface
portion of a silicon substrate, an electrode, an interconnect
and an interlayer insulating film.

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